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CHARACTERIZATION OF THE OLIVE SECTOR IN THE IBERIAN COUNTRIES: THE APPROACH OF A NEW REALITY

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Abstract

The agrifood sector is a sector that, in the context of the global economy, has been registering an intrinsic potential to build, rather than deplete, natural capital. It supports daily and long-term well-being, contributing to economic and social development and, therefore, natural systems. The olive oil subsector has assumed a gradual economic importance in recent years due to the growth in production. However, this phenomenon has not changed Portuguese consumption habits too much, unlike Spain, as we will see. The olive oil line is a strategic route in both countries' agricultural policy and economy. In Portugal and Spain this sector has registered a high level of investment and production, despite the expectation of a certain price stability. The Circular Economy is a recent concept, but it has long been present in the agrifood sector. The creation of "*return circuits*" in agriculture is inspired by the mechanisms of natural ecosystems and is an integral part of these same cycles. From the statistical analysis used, we conclude that there are several ways that the olive sector contributes to the circularity of the economy.

Keywords

olive sector; olive oil production; consumption habits; economic circularity.

Resumo

O sector agro-alimentar é um sector que, no contexto da economia global, tem vindo a registar um potencial intrínseco para construir, em vez de esgotar, o capital natural. Apoia o bem-estar diário e a longo prazo, contribuindo para o desenvolvimento económico e social e, consequentemente, dos sistemas naturais. O subsector do azeite tem assumido uma importância económica gradual nos últimos anos devido ao crescimento da produção. No entanto, este fenómeno não alterou muito os hábitos de consumo dos portugueses, ao contrário de Espanha, como veremos. A fileira do azeite é uma via estratégica na política agrícola e na economia de ambos os países. Em Portugal e Espanha este sector tem registado um elevado nível de investimento e produção, apesar da expectativa de uma certa estabilidade de preços. A Economia Circular é um conceito recente, mas há muito que está presente no sector agro-alimentar. A criação de "circuitos de retorno" na agricultura inspira-se nos mecanismos dos ecossistemas naturais e é parte integrante desses mesmos ciclos. Da análise estatística utilizada, concluímos que são várias as formas como o sector do azeite contribui para a circularidade da economia.

Palavras chave

sector do azeite; produção de azeite; hábitos de consumo; circularidade económica.

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Introduction

The entry of Spain and Portugal to the European Union (EU) corresponded to a remarkable crusade that resulted in a robust edifice that gradually faded away due to the Common Agricultural Policy (CAP). Agriculture in both countries began to have agricultural constraints consequent from the CAP because of changes in pricing policy and agricultural markets, the integration of the two countries into the European Monetary System and adaptations to the new European agrarian legislation (Avillez, 2015; Ardavín, 2008). As the prices of Iberian agricultural products were higher than those of the EU, the two countries went through a process of price harmonization with relevant changes in the marketing channels. The macroeconomic impacts were mainly marked by inflationary processes, economic growth, and the counterproductive effects on the respective trade balances since 1986. Therefore, the CAP has troubled the Portuguese agricultural sector, to which was added the low value of agricultural productivity and the displacement of labour for the services sector and not so much for the industrial sector, which "was no longer able to absorb the work released by agriculture" (Amaral; 2021: 268) from 1996 onwards. Before, in 1980, Portugal and Spain signed a bilateral trade agreement to reduce customs tariffs, including the agricultural sector, which served as a preparation for the two countries for subsequent accession to the EU in 1986 (Costa et al.; 2011: 401). With Spain's accession to the EU, the country also registered a new phase of changes in its productive structure that generated fluctuations in the labour market with the displacement of labour from the primary sector to industry and, later, to services. As in Portugal, labour productivity increased less in the agricultural sector. An undeniable fact is that the whole economy starts with agriculture, which, step by step, is transformed into a set of sectoral activities, although, paradoxically, the primary sector ends up representing little in the Gross Value Added. As for the specific branch of olive oil in general, price variations are the main cause of the repercussions on the sector's gross margins. Higher prices and margins for quality oils mean a lower elasticity of demand in the face of fluctuations in other contiguous goods such as oils (Torres-Ruiz *et al.,* 2012: 7). According to Stempfle *et al.* (2021: 2),

> *"olive oil represents a very relevant agri-food system in the Mediterranean region, accounting for 87% of the 11.5 million hectares dedicated to olive trees (Olea europea L.) worldwide, 86.6% of whom is devoted to olive oil supply"*.

In this context, the aim of this study is to characterize the olive oil sector in Portugal and Spain and the relationships that, at the commercial level, are established between them. We also intend to demonstrate the importance that this sector has for the Iberian Peninsula, as well as the tendency to use the Circular Economy also in the agricultural sector.

1. Linear and Circular Economy: the really sustainable way to produce

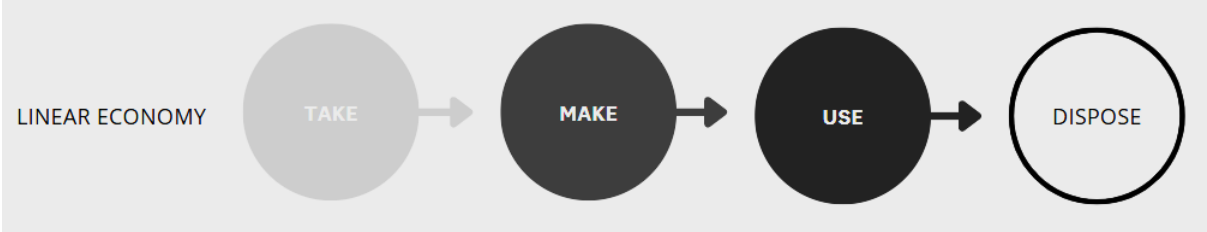
In the field of economic science, the circular economy (CE) model has gained increasing prominence in the transformation of sectoral systems that constitute the various industries. The exposition of the circular economy "proposes a shift towards a new way of satisfying the needs of society" (Borrello *et al*.; 2020: 20), clearly pointing to a path that corrects the inadequate actions of economic agents towards to alter them or change course. For Eurostat (2021),

> *"the circular economy aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimizing the generation of waste"*.

Estrada (2021) was very energetic in advocating for Spain a kind of State pact for olive groves, with special emphasis on improving their productivity. To reconsider the olive oil industry is to reinvent the future of this agri-food commodity in a purpose of cooperation between ecological systems and economic variables, a situation that exists from planting to harvest, but which still brings problems of desirable environmental adequacy for all the actors involved (Cembalo *et al.*; 2020). In contrast, in the traditional production model, that is, in the linear economy, raw materials are used to produce final products that, after being consumed, become disposable items. The circular economy is a new model of sustainable production that is born in contrast to the current model of the linear economy. It could be a possible solution "in the transition to circular food systems, that is, food systems that implement the principles of the circular economy" (do Canto; 2021: 2), in fact, in the wake of the United Nations Sustainable Development Goals. On the other hand, the time variable is a precept to be analysed and managed in the transitions to the agri-food circular economy and possible support to the parties involved and interested. Agro ecological (crop and harvest), agro industrial (food processing) and consumption (food purchase) subsystems of agrifood supply chains are investigated to address the main challenges for the transition towards the CE. Policy makers have the mission to monitor market policies, national or community, and the market itself and its agents provide a public service in helping to ensure the transparency of markets. The aim of the article is to generate a useful analytical framework for practitioners and public

policy makers using macroeconomic variables as shown later. The linear economic model follows the pattern shown in Figure 1. It considers extraction, transformation, use and disposal. It will not be difficult to continue with high waste results with the continuation of this model (Wilts et al., 2016). The linear model is based on the premise that resources are abundant, available, easy to obtain and cheap, therefore, disposable.

Figure 1 – The Linear Economic Model



Source: Wilts *et al*. (2016).

The linear economy has been considered a form of economic organization that tends to be unfeasible. The linear economy (LE) is a form of organization of society based on the increasing extraction of natural resources, in which products made from these resources are used until they are discarded as waste. In this form of economy, the maximization of the value of the products is given by the greater amount of extraction and production. This is because, in the long term, the planetary limits will have reached an unsustainable level of maintenance of this model. It is a result of the industrial revolution and evolution and has not evolved since. Humanity is already experiencing the unsustainability of the linear economy with the growing scarcity of resources, with reflections on increased pollution and human and environmental vulnerability to this pollution. But there is an alternative to the LE that must be presented as a new form of social, economic, and financial organization: the circular economy (CE). In the linear economy, the uncertainty about the availability of resources for the maintenance of the productive and consumption system is increasingly growing, given the existence of limits of the planet and the population. It is almost a revisiting of the Malthusian theory of the 18th century during the industrial revolution. Fluctuation in commodity prices (raw commodities) significantly increases average prices. This not only causes problems for producers and buyers of raw materials, it also increases risks in the market, making investments in the supply of materials less attractive. This can guarantee a long-term increase in raw material prices. There are a number of industries that make extensive use of critical materials in their production activity, e.g. metallurgical industry, computer industry, electronics industry, electrical equipment industry and the transport industry. Dependence on harmful materials makes companies dependent on fluctuations in market prices for materials, not being able to make predictions, thus becoming less competitive than competitors less dependent on these materials. Due to the increase in commercial activities, the interdependence of products has become stronger and stronger. For example, countries with water scarcity but excess crude oil and trade in oil, after being processed, for the food sector results in an interconnection between these commodities in the market. In addition, the production of goods depends on water and fuel. Because of this interdependence, the scarcity of a raw material would have a widespread multiplier impact on prices and the availability of more goods. Another less benevolent aspect of

the linear model has to do with externalities, that is, with the social, economic, and environmental effects indirectly caused by the sale of a product or service. This means that externalities are born in the economy and can be negative or positive for society. Buchholz *et al.* (2017) referred the idea that externalities boil down to the difference between private costs and social costs or between private profits and social profits. If we were to put the positive and negative externalities produced by the effects of the linear economy on a scale, the negative ones would certainly have the greatest weight. They involve damage to ecosystems and a reduction in the shelf life of products. Continuing with the linear model leads to the creation of waste. During the production processes, from consumption to the disposal of products, large flows of materials are generated that are not used but burned or left in any garbage dump. This results in less need for quality products can be used for the long term which encourages consumers to buy new products even faster. In the LE, sustainability is enhanced by a focus on eco-efficiency. This implies maximizing the economic gain that can be realized with a minimized environmental impact. There is, therefore, an alternative to the linear economy that must be presented as a new form of social, economic, and financial organization: the EC exemplary.

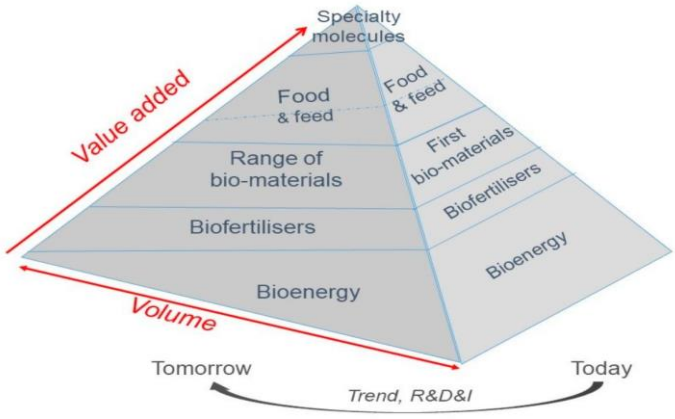
The shift to a circular economy is essential to deliver the resource efficiency plans established, e.g., under the Europe 2020 Strategy, for smart, sustainable, and inclusive growth (Wilts *et al.,* 2016). Thus, it becomes crucial to rethink the entire process that forces a paradigm shift that includes the CE. Going to the origin of the concept of Circular Economy, it appeared in 1966 with the British economist Kenneth Boulding in his work "The Economics of the Coming Spaceship Earth". In the same article, Boulding (1966: 7-8) argued that

> *"man must find his place in a cyclical ecological system which is capable of continuous reproduction of material form even though it cannot escape having inputs of energy".*

Later, environmental economists Pearce *et al.* (1989) explained the change from the traditional open economic system to the circular system, because of the thermodynamic law that dictates the degradation of matter and energy. Differences in olive-to-oil conversion strategies, based on a broader bioeconomy perspective, can be broken down into different ingredient and product categories, potentially leading to additional income for producers. Different conversion strategies based on a broader bioeconomy perspective are valued, that is, they are converted into new, marketable, value-added products. The different conversion strategies based on a broader bioeconomy perspective can be divided into different biomass upgrade categories, specialty molecules, food, feed, ingredients, bio-based industrial materials, biofertilizers and bioenergy, with different priorities.

Figure 2 shows the biomass value pyramid. Biofertilizers and biomaterials have the most value, followed by food and feed ingredients. The greatest added value of the smallest volume is achieved within the fine chemicals or pharmaceutical (health and lifestyle) sector.

Figure 2 - The Biomass Value Pyramid



Source: Donner *et al.* (2021: 4)

National regulations for the production of olives with disposal of by-products, especially for wastewater from mills, exist in several countries such as Spain, Italy or Portugal, but not in all olive oil producing countries, and also not for all types of waste of olives, such as, e.g., leaves, twigs and branches (Donner et al, 2021: 3-4). Although traditionally olive waste and by-products are scattered on land or used for compost, animal feed, energy or heat, a lot of research has been done to develop new and higher value-added biotechnological recovery pathways. According to Stempfle *et al.* (2021: 1)

> *"While creating promising new value chains, radically new ways of handling organic streams can result in drastic decreases of loss and waste production, inputs requirements, virgin, and non-renewable resources usage, and environmental footprint"*,

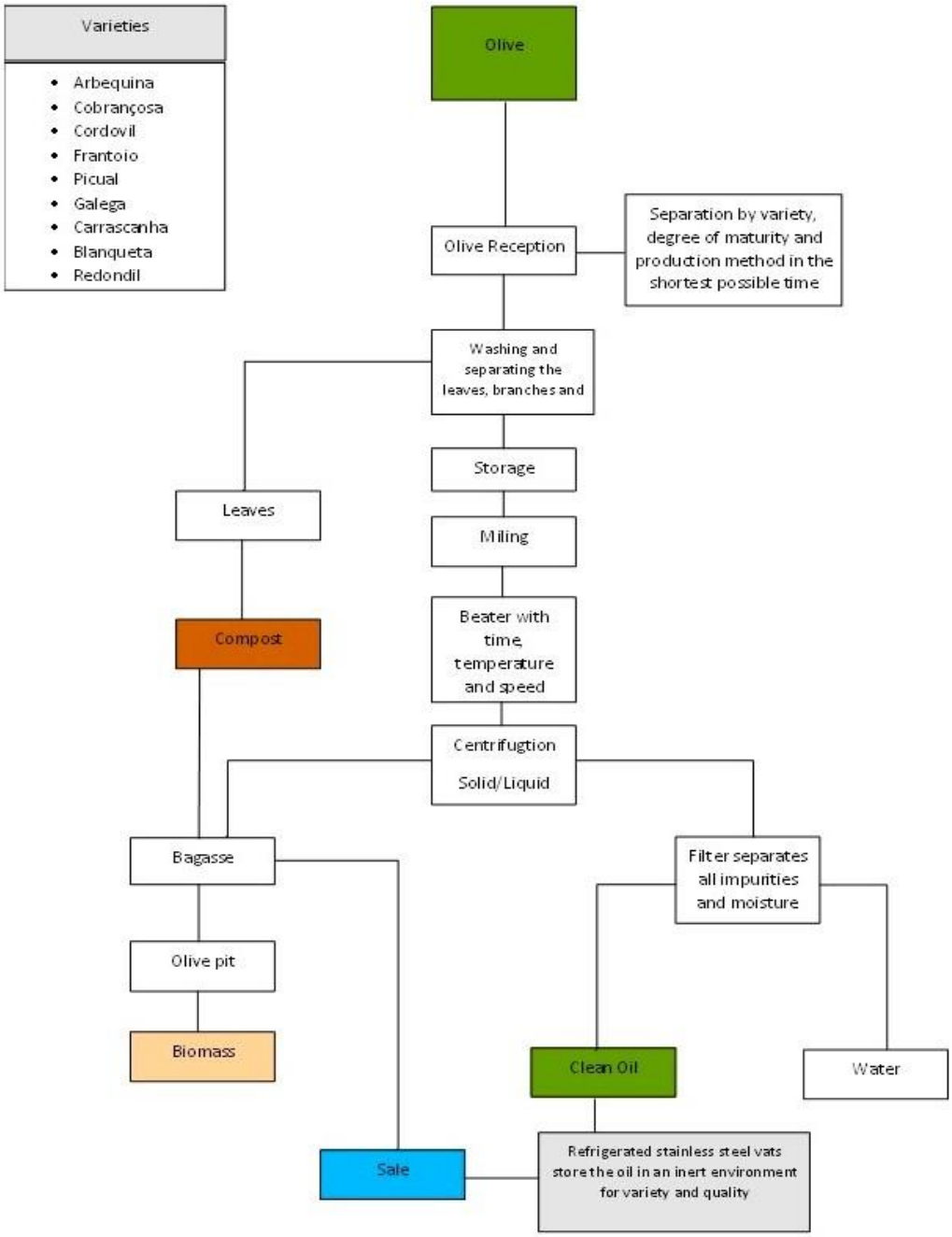
according to the principles of CE. A CE feeds back its own development and thus closes the loop. It is a regenerative economic model that aims to minimize waste and maximize resources. This sustainable economic approach uses a "repair, reuse, recycle" production model, which contrasts sharply with the traditional linear "take, make, dispose" model.

Figure 3 – The Simple Production Cycle of the Circular Economy

Source: edX Courses (2022).

Thus, "waste", which would otherwise approach the end of its useful life in the linear cycle, which would normally go to landfill or incineration, remains in the production cycle through our circular strategies. This is what Figure 3 shows.

Figure 4 – The Olive Oil Reuse Process



Source: Based on Abreu (2018: 57). Own elaboration.

One such event is the solutions to reuse waste from oil mills. The production of olive oils starts from the desire to apply the knowledge acquired in the production of olive oils of

great quality and variety. Thus, producers seek olive oils to be the expression of the land. From multiple varieties, e.g., Arbequina, Cobrançosa, Cordovil, Frantoio, Picual, Galega, Carrascanha, Blanqueta, Redondil, originating from their properties or from partnerships with olive growers, producers seek to value the indigenous varieties of their regions. All olive oils, exclusively of the extra virgin or virgin type, are produced using natural methods and entirely traditional processes, preserving the pure juice of the olives. This ancestral knowledge is the fundamental basis of the Mediterranean diet, which was declared a World and Intangible Heritage of Humanity by UNESCO in 2013. The obsession with the quality of the oil begins in the phase of the fast transport of the olives to the mill. To optimize this process, the constructions have recently been carried out taking into account some old techniques, using rammed earth for the walls and cork for the roof. This makes it possible to maintain natural cooling. When arriving at the mill, the olives are duly chosen and separated according to quality and origin. Subsequently, the production of olive oil is followed as exemplified in Figure 4.

After the production process, the oil is stored in insulated vats with different volumetric capacities, awaiting the subsequent bottling. The CE cannot be seen only as an appropriate approach to waste management, but as an approach capable of restoring the resilience of the planet and at the same time producing economically increasing returns, as well as shared social benefits for the communities where it will be applied (Scheel, 2016). It is therefore essential to innovate in business models and if this is done correctly, we will create countless opportunities. In this way, waste will be seen differently, starting to be seen as opportunities for value creation and not as something disposable.

The olive oil industry currently has technological solutions for the reuse of practically all the waste it produces, from biomass production to animal feed. The production of olive oil results in olive pomace, pits, leaves and rutted water or wet pomace, which are a "*very complex environmental problem*", given that they have a pollutant load 200 to 400 times higher than that of domestic sewage (Olicer, 2022). On average, the olive season in Portugal alone produces wastewater equivalent to the sewage of 2.5 million people (Olicer, 2022). There are several treatment processes, from less expensive, such as retention and evaporation ponds, to more expensive ones, such as biological, thermal, and physical-chemical treatment. Now, most of the residues from the oil mills are being sent to the refinery industry, which removes the remaining oil from the wet pomace for the production of pomace oil, with the remainder being used for burning. All these residues started to be used in a system of transformation into solid fuel and biomass for domestic or industrial boilers. There are also other ways to reuse mill waste. For example, in 2011, there were works in progress aimed at valuing the olive leaf in animal feed (Consalvo *et al.*, 2011). The results obtained then indicated a strong potential for application in diets for rabbits and ruminants. There may be other solutions to improve water treatment, waste, and greater production efficiency, using solar energy sources to produce olive oil (Monteleone *et al.*, 2014), (Chávez-Dulanto *et al*., 2020). The olive oil sector has, in fact, undergone a great evolution in recent decades and technology today provides many answers for practically all waste. However, these technologies and solutions still have a relatively high cost. Olive leaves are fibrous and poorly digestible, especially in terms of crude protein, and therefore promote very poor rumen fermentation. However, when fresh, they have a superior nutritional value and can be successfully included as a supplement in the animal diet (Consalvo, 2018). As part of a

bioeconomy project, with a view to providing a more global solution to this waste, the University of Trás-os-Montes and Alto Douro developed the BioCombus project that uses the by-products of olive harvests and transforms them into biomass, which can be used as solid fuel for domestic boilers. The process of the BioCombus project mixes waste from oil mills with waste from the Cork Industry, obtaining, as a final product, a solid biofuel with great potential for recovery, high calorific value and which does not constitute an environmental problem.

> *"It is a global solution because we are doing a treatment to comply with the law and in addition we are creating commercial added value "*,

emphasizes the study (National Rural Network, 2022). In recent years, the supervisory authorities have controlled the oil mills and the registered ones are less and less non-compliance with the operating rules, from licensing to waste treatment. For example, in Portugal, the "Lagareiro 2015" operation, carried out by the Nature and Environment Protection Service, was ongoing and ran until January 31, 2016.

An overview of the olive oil market in Iberian countries

The scope of the CE model synthesizes a series of important schools of thought, highlighting, for example, the work performance of Walter Stahel, energy in circular economies to eliminate waste according to William McDonough, biomedical learning with cultivation Janine Benyus's resilient approach to food ecology, Reid Lifset's vision of industrial ecology, Thomas Graedel's mainstay in the ecosystem, L. Hunter Lovins and Paul Hawken's conception of natural capitalism, and Gunter Pauli's blue economy approach. In agribusiness as a whole and more specifically in the oilseed sector, combating losses and waste requires a differentiated look at operational, production and consumption practices, leading to changes in the entire production chain of companies, here emphasizing the olive oil producers (Mor et al., 2021). One of the main changes relates to the transformation of losses and waste, or any type of waste, into something useful and reintroducing it into the value chain. This concept is the basis of the design of the EC, as we have seen. If we assume that the production of olive oil takes place in an oligopoly market, an increase in demand can lead to a reduction in prices because in a more robust market like this, especially in Spain, sooner or later it will induce innovations and, in theory, the entry of more efficient suppliers in production and, therefore, lower margins due to the effect of competition (Jaravel, 2018: 557). Therefore, looking for sustainability in both agribusiness and the food industry is much more than just concern for the environment. In terms of production, Portugal made an extraordinary quantitative and qualitative leap. The quality of the olive oil is nationally and internationally confirmed, having become a reference exporting country with the merits that this has implied in the trade balance. Structurally, Portugal is on the right path by investing in quality, thus offsetting its deficit in scale at European level. Portuguese olive oil has a notable presence in Brazil, representing around two thirds of exports, built, and consolidated over the years thanks to brands and consumers who value the origin of the product (Olive Emotion; 2018). In the remaining markets, competition from the most important European producers, especially Spain and Italy, is immense. Spain and Italy are references for

customers and consumers in terms of the origin of olive oil. Brands originating in Spain have built a robust relationship in different geographies, with emphasis on the United States, France, Germany, and the United Kingdom (Kyger; 2019). It is easy to say, but the difficult thing is to execute and to enter the distribution of the various geographies requires time and a strong capacity to invest. As for Portuguese olive oil, this is a solid obstacle to overcome due to the shyness of Portuguese brands due to the country's scale effect. The alternative is to use a strategy of affinity with consumers and a selective distribution due to the shy quantity effect. There is, therefore, much to do in Portugal compared to Spain.

A Portuguese consumes an average of seven litres of olive oil per year, which compares with nine in Spain, ten in Italy and sixteen in Greece (Cruz; 2020). In Portugal, the main type of olive oil that is consumed is extra virgin, which is the highest quality. Therefore, for the Iberian countries, apart from the size of the difference in the area of useful cultivation, only with quality is it possible to expand consumption, conquer new consumers and seek to penetrate even more in the various markets. There are immense opportunities to enhance the Iberian olive oil category, if not only the quality is maintained but also the appreciation of experience, be it production or consumption.

The methodological analysis and the effects on olive macro-relations

We gathered statistical information from Eurostat data which, according to this organization, are "*agricultural statistics produced in the form of an agricultural census*" (Eurostat, 2020). With the selected data, we define the variables to be considered and evaluate their performance and, later, their interpretation and behaviour. From the analysis performed, the following graphs were created using RStudio Team (2020). RStudio is an integrated development environment (IDE) for the R language (R Development Core Team, 2008), a programming language for statistical and graphics computing. To create these graphs, the Geom point function was used. This function adds a layer of points to a plot, which allows you to create Scatter Plots.

Table 1 – Variables considered

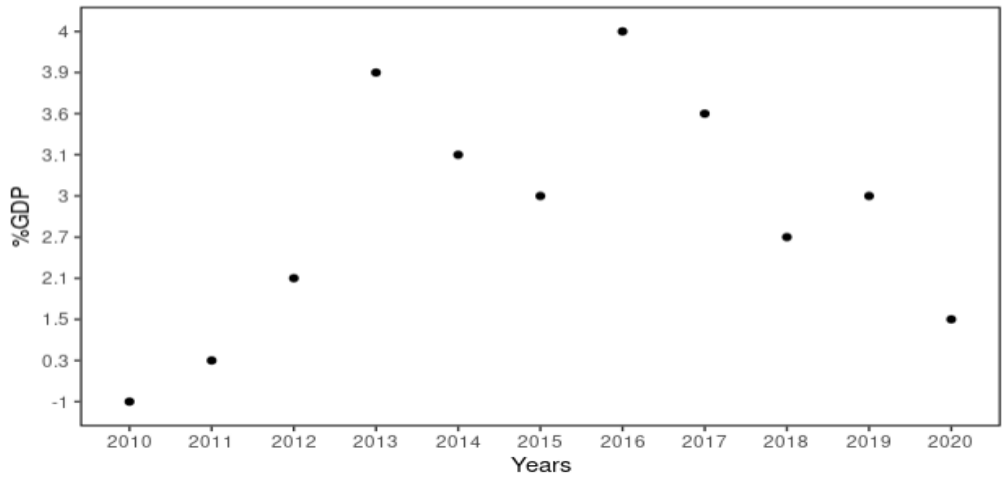
Variables	
Trade Balance for Spain	
Agricultural Account for Portugal	
Agricultural Account for Spain	
Olive Oil Production for Portugal	Private
	Cooperative
	Industrial
Constant Prices for Spain	
Constant Prices for Portugal	
Olive Oil Production for Portugal	
Olive Oil Production for Spain	
Trade Balance for Portugal	Service Exportation
	Goods Exportation
	Service Importation
	Goods Importation

Source: own elaboration.

These graphs are typically representations of two or more variables arranged in a graph. The data is represented as a collection of points, where each point represents the individual value of each of the components of the data set using Cartesian coordinates (X, Y). The Scatter Plot is used to observe and demonstrate relationships between variables, such as checking how one variable can influence another.

In the study, we considered fourteen variables that are shown in Table 1, adjusted as per our own elaboration. As for the Trade Balance for Spain variable, as shown in Graph 1, it reached the highest value as a percentage of GDP in 2016. Since then, the values have been decreasing, except for the year 2019, when it rose 0.3 % compared to 2018. Comparing 2020 with 2016, the value is less than half of that presented in 2016. Still in Graph 1, we can see that Spain had its lowest value in 2010. The values increase until 2013, with the largest difference between 2012 and 2013. From 2013 to 2015 it drops, reaching the highest percentage value of the GDP in 2016, declines again and rises slightly in 2019.

Graph 1 – Trade Balance for Spain

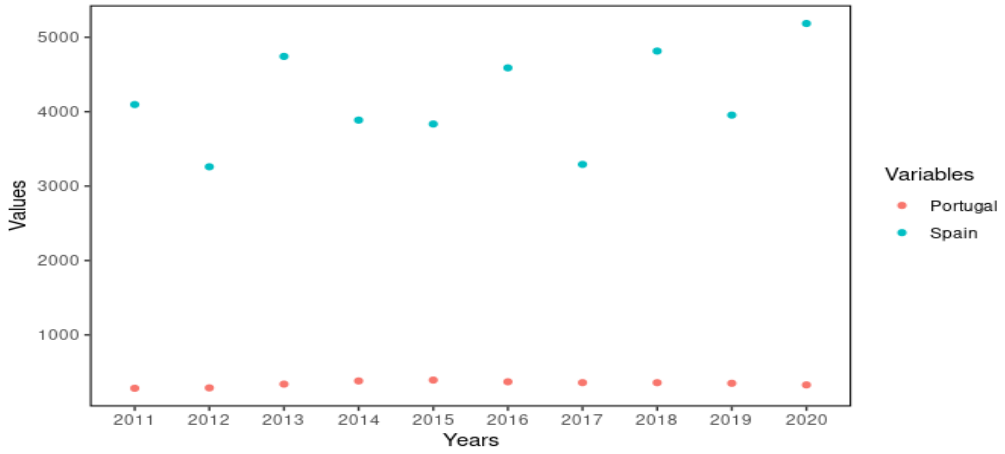


Source: own computation.

Regarding the metric used through the Constant Prices variable, according to Graph 2, for Portugal the year 2020 was one of the years with the lowest values, and in 2011 and 2012 they were even lower. The year 2015 was the year with the highest price value. As for Spain, 2020 was the year in which the highest value was recorded since 2011. The lowest value was recorded in 2012 and decreases were recorded again from 2013 to 2014 and from 2014 to 2015.

As an ex-ante note, and as we will see later, we found that in the same years there were drops in the values for the Agriculture Account variable. For Portugal, the values remained more or less constant over the years. Spain did not have such an evident trend. Until 2015, we found that in odd-numbered years the values were higher than in even-numbered years. This pattern was inverted from 2015 onwards, when even years had higher values than odd years.

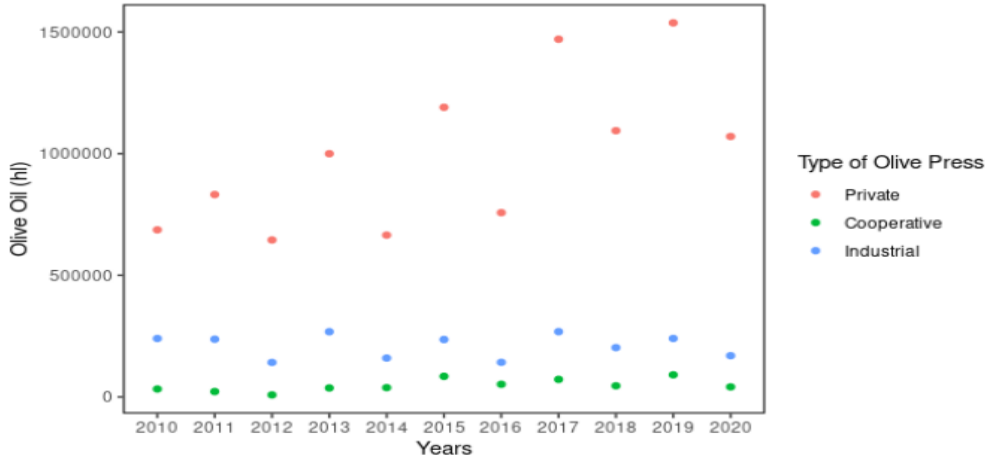
Graph 2 – Constant Proces for Portugal and Spain



Source: own computation.

Regarding the variable Olive oil production for Portugal, production at a particular level remained the most persistent over the time analysed. Clearly, industrial production was the most representative, both for each year and in the data set over all the years. In even years there was always a drop in production, with the biggest drop in 2020, in early 2020 due to confinements, but later the pandemic did not influence Portuguese foreign trade (Amador et al; 2021). The year 2012 was the year with the worst production at the private and cooperative levels. The behaviour of this variable can be seen in Graph 3.

Graph 3 – Olive Oil Production in Portugal



Source: own computation.

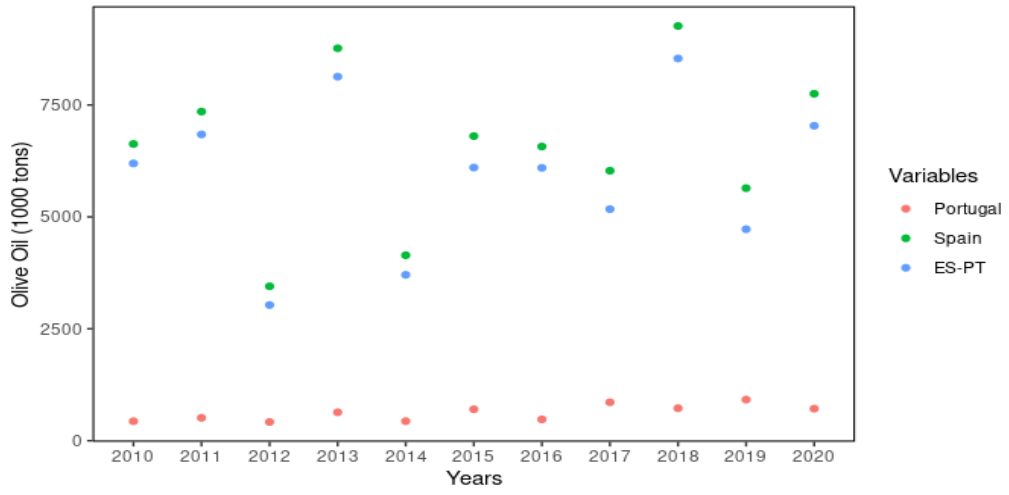
Overall, olive oil production in Portugal was higher in the private sector. At the cooperative and industrial level, production remained more or less stable, with greater expression at the industrial level. This does not prevent the sector's competitiveness in

the future from depending on a more effective organization of the distribution chain, seeking to obtain quality oils, an element that is a necessary, although not sufficient, requirement to obtain a better evaluation of the oils produced.

Let's now look at the performance of the variable Olive Oil Production for Portugal and Spain via Graph 4. In 2017 and 2019 Portugal managed to increase production and Spain decreased but for the years 2018 and 2020 this situation is reversed with Spain producing more.

Clearly Spain has a much higher production than Portugal, both in terms of geographic scale and in terms of cultivated area. About 95% of the world's olive-growing area is concentrated in the Mediterranean Basin, with the European Union being responsible for 67% of the world's olive oil production and for 53% of the world's olive oil consumption (European Commission; 2020). Portugal produces about 1% of the world's olive oil production. In the agri-food sector, olive oil represented, e.g., in 2015, about 6.8% of Portuguese exports (GPP, 2017). Spain exported around 79.1% and imported 12.3% in November 2021 (Ministerio de Agricultura, Pesca y Alimentación, 2021).

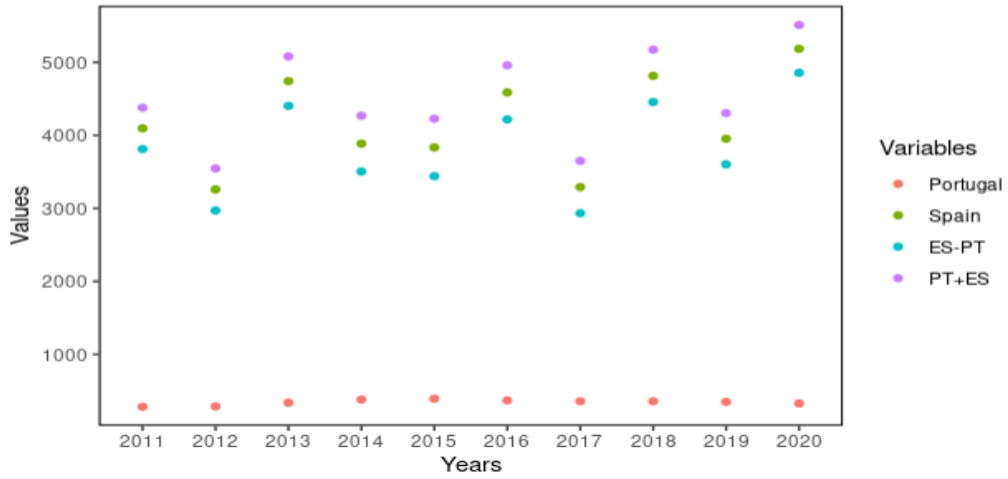
Graph 4 – Olive Oil Production for Portugal and Spain



Source: own computation.

The performance of the Agricultural Account for Portugal and Spain variable, which is shown in Graph 5, is very similar to that shown in Graph 4, which shows the behaviour of the Olive Oil Production for Portugal and Spain variable. For Portugal the lowest value was in 2011 and the highest in the agricultural account was reached in 2015, decreasing afterwards until 2020. For Spain there were ups and downs. The highest value was reached in 2020. In 2014 and 2015 the values were very close. ES-PT and PT+SP reflect the difference and the sum, respectively, of the agricultural accounts between the values of Spain and Portugal. Both options serve to compare how the two countries can or cannot influence each other, that is, to understand whether they can influence each other positively or negatively.

Graph 5 – Agricultural Account for Portugal and Spain

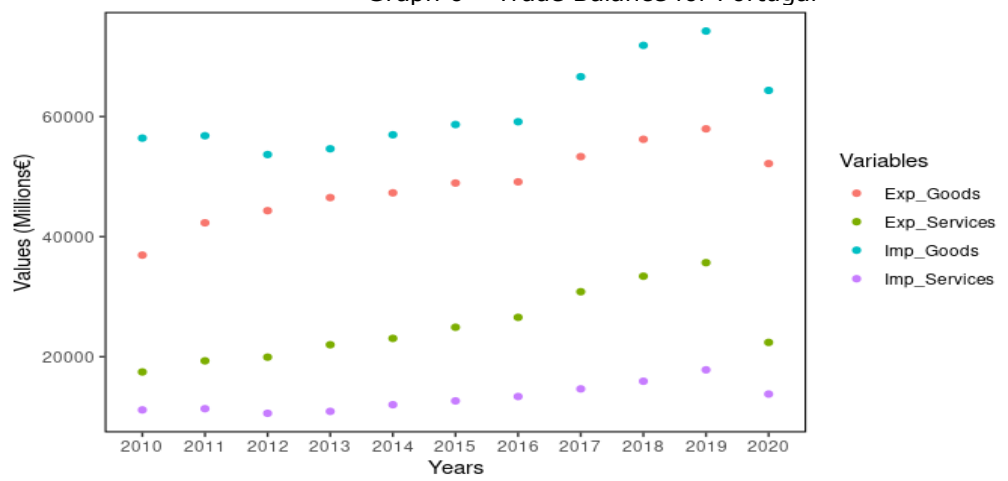


Source: own computation.

As in Graph 2, which reflects the variable Constant Prices for Portugal and Spain, there was a trend until 2015 in odd years with higher values than in even years, which was later reversed. When we calculate the difference or the sum of the agricultural accounts, we see that Portugal does not have a great influence on the accounts of Spain because it also has a lower production and naturally proportional to the available cultivated land.

Let's see the behaviour of the Trade Balance for Portugal variable in Graph 6. For the year 2020, all imports and exports dropped due to the pandemic. We imported much more goods than we were able to export, mainly between 2010 and 2013. From 2012 to 2016, we approximated the import and export values of goods, even though we import more than we export. In services, the situation is reversed. There is a correlation that has been expressed, as we export more, we also end up importing more. This trend is more significant from 2012 onwards for imports and exports of goods and for services we see that since 2010 this has happened.

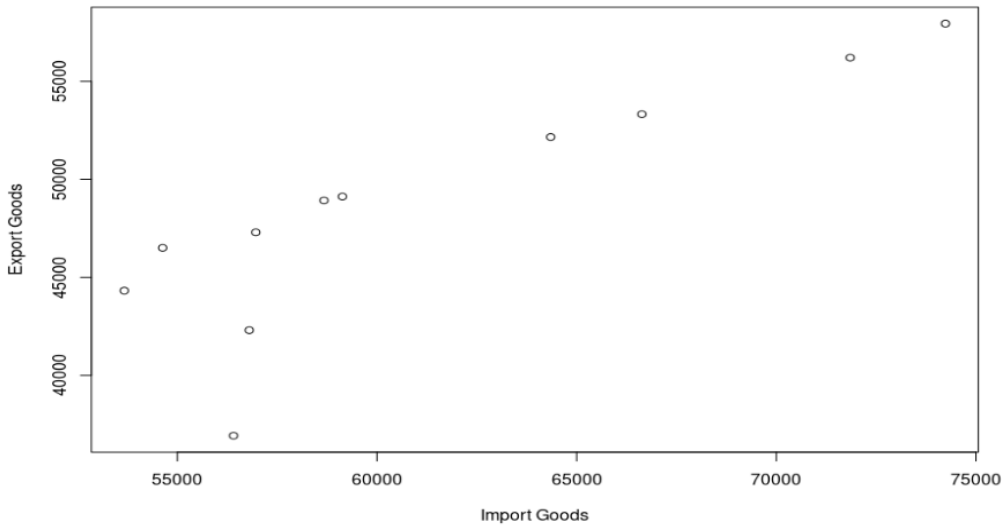
Graph 6 – Trade Balance for Portugal



Source: own computation.

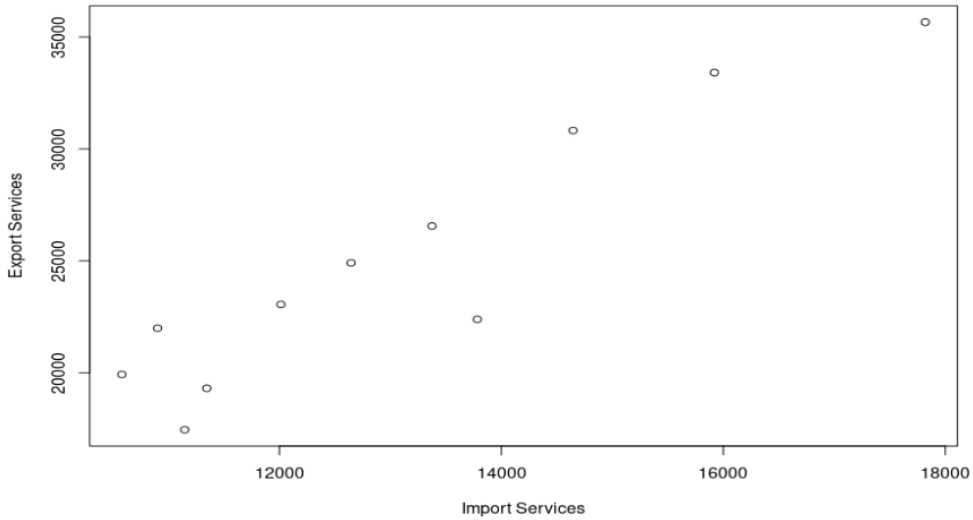
In the Portuguese case, the trend is explained by the fact that when exports increase, imports also increase in terms of goods. However, in services we export more than we import. According to Eurostat, in 2018, Portugal was the third country that most exported this product among the 28 Member States, after Spain and Italy (Eurostat, 2019). However, most (63%) of the olive oil exported by Member States is imported by their neighbours. Also, from this point of view, Spain and Italy dominate exports. The variables Comparison between Imports and Exports of Goods and Comparison between Imports and Exports of Services, expressed in Graphs 7 and 8, confirm the trend observed when we analyse the performance of the Trade Balance for Portugal variable, shown in Graph 6.

Graph 7 – Comparison between Import and Export of Goods



Source: own computation.

Graph 8 – Comparison between Import and Export of Services



Source: own computation.

Thus, it is possible to see in these Graphs that regardless of whether they are imports or exports of goods or services, and as we wrote before, when exports increase, imports also increase. With regard to olives for olive oil, after a year of off-season, flowering was beneficial, giving rise to a significantly higher fruit load than that achieved in the previous 2019-2020 campaign, according to the National Statistics Institute (INE, 2021:20). In Portugal and Spain, since the beginning of our analysis, there has been an increasing weight of intensive and traditional rainfed olive groves, after prolonged droughts, as well as an increasing weight of irrigated olive groves, with positive effects on production and productivity.

Discussion of results

As can be seen from the graphs above, Spain has a higher olive oil production than Portuguese production. This difference may be because Portugal has a smaller land available for production or the fact that it is more specifically dedicated to the quality produced and there is no quantity, like Spain, all as a result of the problem of scale existing between the Iberian countries.

Table 2 – Statistical measures

Variables		Mean	Median	Variance	Percentiles					Maximum	Minimum	Standard Deviation	Coefficient of Variation
					0%	25%	50%	75%	100%				
Trade Balance for Spain		2.381818	3.0	2.441636	-1.00	1.80	3.00	3.35	4.00	4.0	-1.0	1.562574	0.6560424
Agricultural Account for Portugal		345.091	354.155	1339,284	283.1100	331.1025	354.1550	367.3925	393.2900	393.2900	283.1100	36.59623	0.1060481
Agricultural Account for Spain		4165.036	4024.685	421651.7	3259.140	3847.267	4024.685	4703.850	5184.800	5184.800	3259.140	649.3472	0.1559043
Olive oil Production for Portugal	Private	47777.27	41259	6,55E+08	8307.0	34733.5	41259.0	62265.5	90925.0	90925.0	8307.0	25584.79	0.5355013
	Cooperative	209774.6	236145	2,35E+09	141925.0	164816.5	236145.0	240353.5	268380.0	268380.0	141925.0	48429.08	0.2308624
	Industrial	737916.4	694804	7,14E+10	413958	528945.5	694804.0	864636.5	1206206.0	1206206.0	413958	267146.6	0.3620283
Constant Prices for Spain		4165.036	4024.685	421651.7	3259.14	3847.267	4024.685	4703.850	5184.800	5184.800	3259.14	649.3472	0.1559043
Constant Prices for Portugal		345.098	354.155	1340.034	283.11	331.1025	354.1550	367.3925	393.3600	393.3600	283.11	36.60648	0.1060756
Olive Oil Production for Portugal		620.92	634.21	31382.5	417.95	456.605	634.210	720.275	917.910	917.910	417.95	177.1511	0.2853042
Olive Oil Production or Spain		6582.147	6628.81	3093423	3448.61	5836.465	6628.810	7551.685	9264.54	9264.54	3448.61	1758.813	0.2672096
Trade Balance for Portugal	Service Exportation	25047.54	23054.7	35526063	17463.80	20963.45	23054.70	28694.00	35664.70	35664.7	17463.8	5960.374	0.2379625
	Goods Exportation	48640.52	48925.5	38112190	36922.2	45413.9	48925.5	52744.6	57950.4	57950.4	36922.2	6173.507	0.1269211
	Service Importation	13107.41	12646.2	5260237	10580.9	11246.8	12646.2	14215.1	17819.5	17819.5	10580.9	2293.521	0.174979
	Goods Importation	61213.85	58671.5	49362766	53670.4	56604.25	58671.50	65491.95	74237.00	74237.00	53670.4	7025.864	0.1147757

Source: own elaboration

Table 2 shows a synthesis for all variables under analysis using measures of central tendency, such as the mean and median, measures of dispersion that allow determining the degree of variation of the values in relation to the mean, such as standard deviation

and variance, as well as measures of relative position, using, in this case, percentiles. This table allows numerical confirmation of the observations made from the above graphs. There is a spread between the values of the variables Trade Balance for Spain and Private Olive Oil Production for Portugal, which means that there can be much higher and much lower values within each variable. The values are more unanimous among them when referring to the remaining variables, which have a coefficient of variation below 0.5. The values of the selected variables are quite different from each other in relation to the others > 0.5. Agricultural Account for Portugal is the variable that presents the most constant growth, this is proven, if we check the values in the percentiles, which allows us to have an idea of how the ordered data of the sample are divided. In this case it is divided into 5 equal parts of 25%. The variable on the production of olive oil in Portugal in the private sector is the one that presents the highest value in terms of the coefficient of variation, this means that it is the variable that presents the most different values in relation to the average, thus demonstrating that it does not have a set homogeneous data, as evidenced by graph 4.

Conclusions

The linear economy combined with the increase in the world population has caused a growing demand for raw materials, many of them scarce and finite. In addition to the dependence of some EU countries on other countries for the raw materials needed, the extraction and use of these raw materials increases energy consumption and CO2 emissions with a major impact on the environment. In this follow-up, the circular economy emerges, constituting a new model of sustainable production that is born in contrast to the current model: the linear economy. This change is also felt in the agricultural sector, particularly in the olive oil sector. In recent years, the Olive Oil Sector has assumed a growing economic importance not only in the Iberian context, but also internationally, as can be confirmed by the indicators presented that illustrate the recent evolution of the sector and its main current characteristics.

In terms of volume, it is clear that olive oil production is lower in Portugal, even with irregular periods. Spain has a much higher production, although with more fertile years than others. The Agricultural Account for Spain variable showed several oscillations, and it is always much higher than Portugal. Portugal exports more services and imports more goods. Spain has a trade balance with sharp growth between 2010 and 2013 and a sharp decrease between 2016 and 2018, with the result that the year with the highest value in terms of percentage of GDP was in 2016. In terms of Constant Prices for Portugal, they remained constant, but for Spain there are instabilities.

Therefore, along with all existing diplomatic efforts between Portugal and Spain, we believe that for the specificity of this agricultural product and given the existing relations that these should be maintained, or even encouraged. The existence of greater links between Portuguese and Spanish companies should also be promoted, taking advantage of the leverage that the existing geographical proximity can effectively provide.

We believe that our study contributes to the literature on the Iberian Peninsula olive oil trade. The economic importance of the Iberian olive oil sector has good prospects for future developments, albeit at a slower rate of growth than in the last decade. It can be leveraged through the establishment of partnerships that allow the sharing of risks, the

expansion of the range of products and the strengthening of the competitive position in foreign markets, without jeopardizing the independence of the participating entities, thus promoting internationalization.

In the future, we intend to extend our analysis to the new productive processes of this product, a subject that we have already addressed in this article, to be able to analyse whether this new reality implied any change in terms of the results obtained.

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